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8 **BEFORE THE**
9 **CALIFORNIA STATE WATER RESOURCES CONTROL BOARD**

10 HEARING IN THE MATTER OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
11 AND UNITED STATES BUREAU OF
RECLAMATION REQUEST FOR A CHANGE
12 IN POINT OF DIVERSION FOR CALIFORNIA
WATER FIX
13

TESTIMONY OF GWEN BUCHHOLZ
(EXHIBIT DWR-80)

14
15 I, GWEN BUCHHOLZ, do hereby declare:

16 I am an expert and my expertise was established in DWR-32 and DWR-72 previously
17 submitted in this hearing.

18 **I. EFFECTS OF PROPOSED INTAKE, TUNNEL, AND FOREBAY FACILITIES ON**
19 **GROUNDWATER RECHARGE**

20 **POTENTIAL ISSUES:**

21 Placement of slurry walls around California WaterFix (CWF) intakes and forebays and
22 installation of the tunnels between the intakes and forebays would reduce the subsurface
23 movement of instream freshwater flows from the Sacramento and San Joaquin rivers and
24 tributary water bodies which would affect groundwater recharge. These issues were
25 discussed by:

- 26 • These issues were introduced by Dr. Steffen Mehl on behalf of Sacramento County
27 Water Agency (SCWA) in Exhibit SCWA 4 and discussed at the State Water
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1 Resources Control Board (SWRCB) hearing on October 26, 2016 [pages 126-135
2 and 230-232 of the transcript].

3 • Russell van Loben Sels on behalf of the Local Agencies of the North Delta (LAND)
4 at the State Water Resources Control Board (SWRCB) hearing on November 10,
5 2016 [pages 50 - 51 of the transcript].

6 • Richard Elliot on behalf of LAND at the SWRCB hearing on November 10, 2016
7 [pages 62 – 65 of the transcript].

8 • Josef Tootle on behalf of LAND in written testimony (Exhibit LAND 35) and at the
9 SWRCB hearing on November 10, 2016 [pages 78 – 98, 130 – 151, and 224- 235 of
10 the transcript].

11 • Barbara Daly on behalf of North Delta CARES at the SWRCB hearing on December
12 13, 2016 [pages 176 – 184 and 216 - 220 of the transcript].

13 • Mark Pruner on behalf of North Delta CARES at the SWRCB hearing on December
14 13, 2016 [pages 222 - 229 of the transcript].

15 **RESPONSE SUMMARY:**

16 Based upon the preliminary hydrogeological assessment, groundwater recharge will
17 not be impacted to any large extent. Groundwater wells near the proposed intakes include
18 individual domestic and agricultural wells. The Sacramento County Water Agency, Zone
19 40, wells are located to the east of Interstate 5. The portion of the groundwater basin
20 underlying Zone 40 and near the Sacramento River is recharged by a combination of water
21 from the Sacramento River and groundwater flows from the areas located to the east of
22 Interstate 5. Slurry walls would be constructed at Intakes 2, 3, and 5 along the Sacramento
23 River, and would extend for less than 24 percent of the total length of the Sacramento River
24 eastern bank between Intakes 2 and 5.

25 The mechanisms of groundwater recharge vary at each of the intakes, along the tunnel
26 alignment, and at each of the forebays due to changes in geology and the presence of
27 surface water bodies. In the northern portions of the alignment, soil characteristics are
28 more favorable to groundwater recharge due to the presence of interspersed layers of

1 sands, silty sands, and clays. Groundwater recharge potential becomes less south of
2 Lambert Road due to the increased presence of clay soils. The tunnels would be located
3 within the clay soils at depths below the more permeable soils; therefore, groundwater
4 would continue to flow from the adjacent water bodies in the upper soil layers above the
5 tunnel structures.

6 It also should be recognized that the BDCP/CWF EIR/EIS acknowledges that
7 detailed hydrogeological analyses were not completed during the preparation of the
8 EIR/EIS. As part of the environmental commitments of the project, thorough site
9 investigations and desk studies would be conducted during design to identify the location of
10 wells, depths of the wells and the depth to groundwater in the vicinity of the construction
11 activities. Based upon the results of these studies, it is anticipated that monitoring wells
12 would be installed prior to construction, and mitigation measures would be implemented if
13 groundwater elevations declined due to the implementation of the proposed project.

14 **1. GROUNDWATER RECHARGE EAST OF INTERSTATE 5**

15 As presented in SCWA 4 and discussed in oral testimony, Dr. Steffen Mehl
16 discussed that the EIR/EIS did not address potential changes in groundwater east of
17 Interstate 5 due to the operations of the CWF intakes; and that the operations of the
18 CWF intakes would affect groundwater in that area. The assertions of Steffen Mehl are
19 not supported by the evidence. Groundwater model results in the BDCP/CWF EIR/EIS,
20 Figure 7-14, show that a maximum reduction of 5 feet in groundwater elevations along
21 the Sacramento River would occur due to operations of five intakes under Alternative
22 1B and that the changes in groundwater elevations would not affect groundwater near
23 Interstate 5. The results would be similar under the proposed Alternative 4A as can be
24 determined by comparing the minimum Sacramento River flows under Alternatives 1B
25 and 4A.

26 Groundwater conditions within the groundwater basin to the east of the intakes have
27 been analyzed in several studies over the past 15 years, including the 2004
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1 *Sacramento County Water Agency Groundwater Management Plan, 2005 Sacramento*
2 *County Water Agency Zone 40 Water Supply Master Plan, 2006 Central Sacramento*
3 *County Groundwater Management Plan, and Sacramento Central Groundwater*
4 *Authority Basin Management Report 2009-2010.* Information in these studies describe
5 that groundwater in the groundwater basin is recharged from rivers (Cosumnes,
6 American, and Sacramento rivers), deep percolation of applied water, and subsurface
7 flows along the Sierra Nevada foothills. Figure 2-16 of the 2006 *Central Sacramento*
8 *County Groundwater Management Plan* indicate that the Sacramento River provides the
9 smallest amount of groundwater recharge to the groundwater basin (see Attachment 1).
10 The majority of the recharge occurs along the Cosumnes River and small streams that
11 flow from Sierra Nevada foothills and from deep percolation of applied water.
12 Information presented in the *Sacramento Central Groundwater Authority Basin*
13 *Management Report 2009-2010* (Figures 4 through 7) show the groundwater elevation
14 contours with the most recent contours shown in Figure 7 (see Attachment 2).
15 Groundwater within an aquifer flows from higher elevations to lower elevations, and the
16 rate of flow will increase along steeper elevation changes (e.g., areas with contour
17 changes occurring with the least amount of horizontal space). Based upon the
18 groundwater contours shown in Figure 7 of the *Sacramento Central Groundwater*
19 *Authority Basin Management Report 2009-2010*, it appears that the lowest groundwater
20 elevation occurs near Elk Grove, and groundwater primarily flows towards this portion of
21 the groundwater basin from the east. Groundwater elevations near the Sacramento
22 River appear to only be slightly higher than the lowest elevations near Elk Grove. This
23 report also describes that groundwater elevations in these portions of the basin have
24 recently been stable or have increased due to increased use of surface water in the
25 area and fallowing of lands previously irrigated with groundwater.

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1 Therefore, based upon the information presented in these reports, recharge in the
2 groundwater basin that includes areas east of the Sacramento River, especially to the
3 east of Interstate 5, would not be substantially affected by placement of slurry walls
4 around the proposed Intakes.

5 **2. GROUNDWATER RECHARGE ALONG THE SACRAMENTO RIVER NEAR THE**
6 **PROPOSED INTAKES**

7 As presented in LAND 35 prepared by Mr. Tootle and oral testimony presented by Mr.
8 Tootle, Ms. Daly, Mr. Elliot, Mr. Pruner, and Mr. van Loeben Sels, it was discussed that
9 operations of the CWF intakes would reduce groundwater recharge in the vicinity of the
10 intakes due to installation of the slurry walls. These assertions, however, are
11 contradicted by the evidence that the groundwater in the vicinity of the intakes would
12 continue to be recharged by a combination of general groundwater flow within the
13 groundwater basin primarily from the east towards the Sacramento River, groundwater
14 flows from the Sacramento River, and deep percolation of applied irrigation water. As
15 shown in Exhibit SWRCB 104, the slurry walls at the three intakes would represent less
16 than 24 percent of the total Sacramento River bank between Intakes 2 and 5.

17 Groundwater between the Sacramento River and Interstate 5 in the vicinity of the
18 intakes is recharged by a combination of general groundwater flow within the
19 groundwater basin primarily from the east towards the Sacramento River, groundwater
20 flows from the Sacramento River, and deep percolation of applied irrigation water.
21 Water appears to flow from the Sacramento River into the adjacent groundwater
22 through permeable sands, silty sands, and sandy silt soils along the banks.

23 Geotechnical borings in the vicinity of the intakes were completed by DWR, as reported
24 in Exhibit DWR-212 figure 3-2a, p.52. Soils near Intakes 2, 3, and 5 within
25 approximately 100 to 120 feet of the ground surface appear to consist of silty sands,
26 poorly graded sands, and sandy silts. These soils generally allow groundwater to flow
27 from the Sacramento River to the groundwater basin located to the east of the river.

28 Soils at elevations below 120 feet generally become clays or clays interspersed with

1 sandy silts, which would have less permeability for groundwater recharge. Although not
2 included in the proposed project, soils near Intake 4 (located between Intakes 3 and 5)
3 within the 100 feet of the ground surface consist of silty sands and clays, and therefore,
4 are slightly less permeable than soils near the other intakes.

5 Similar soil conditions near Intakes 2, 3, and 5 also were discussed in Exhibit DWR 212
6 [pages 277-298, including Figure 6 on page 295]. Overall, it appears that soils between
7 Intakes 2 and 5 would have good permeability for groundwater recharge within the first
8 100 feet of soil, and lower permeability below 100 to 120 feet.

9 3. POTENTIAL EFFECTS OF SLURRY WALL INSTALLATION AT THE PROPOSED 10 INTAKES

11 The majority of the groundwater basin located to the east of the Sacramento River in
12 the vicinity of the proposed intakes would be substantially recharged from surface
13 waters and groundwater sources located to the east of Interstate 5. Groundwater
14 between the Sacramento River and Interstate 5 in the vicinity of the intakes are
15 recharged by a combination of groundwater flow from the east, from the Sacramento
16 River, and deep percolation of applied irrigation water.

17 Intakes 2, 3, and 5 would include slurry walls that would extend along the Sacramento
18 River bank. The length of these intake structures would be 1,969; 1,497; and 1,901 feet,
19 respectively, between River Miles 41.1 and 36.8 (Exhibit SWRCB 104). The total length
20 of intake facilities would represent approximately 5,367 feet, or less than 24 percent of
21 the total Sacramento River bank between Intakes 2 and 5. The slurry wall would
22 generally extend along the fish screen section of the intake and the areas where the fish
23 screen connects to the levee. The slurry wall would not extend along the entire length of
24 the relocated levee roadway, as shown in Exhibit DWR 212 [Figure 7 on page 296].

25 It is understood that the slurry walls would interrupt the flow of groundwater from the
26 Sacramento River at the intake locations. However, the slurry walls between Intakes 2
27 and 3 and between Intakes 3 and 5 would be separated by more than 8,900 and 13,000
28 feet of Sacramento River bank, respectively.

1 Because groundwater levels near the Sacramento River appears to be higher than
2 groundwater elevations east of the river (see Attachment 2), groundwater would tend to
3 flow towards the east, including flowing around obstacles (e.g., slurry walls) to move
4 towards the lowest groundwater elevations near Elk Grove. The soils along the
5 Sacramento River bank between Intakes 2 and 5 appear to be relatively permeable, and
6 it appears that groundwater would flow towards the east, including around the slurry
7 walls, and continue to recharge the groundwater in the vicinity of the intakes.

8 As was discussed by Richard Elliot and Josef Tootle, Exhibit LAND 58 indicates that
9 existing groundwater wells are located near Intakes 2 and 3. As discussed above and
10 indicated in Exhibit DWR 212 [Figure 7 on page 296], the slurry walls are not anticipated
11 to extend along the roadway modifications on either side of the intakes. Therefore, the
12 slurry walls would not be located along the river bank to the west of Wells W1 through
13 W12. The tunnels between Intakes 2 and 3 would be located at depths of 90 to 130 feet
14 below the ground surface; and the soil conditions would primarily be characterized as
15 loose to moderately dense sand to approximately 70 feet below the ground surface and
16 underlain by stiff, moderate to high plasticity clay near Intake 2; and loose to moderately
17 dense sand with interbedded loose/medium stiff sands and clays to approximately 100
18 feet below the ground surface and underlain by stiff, moderate to high plasticity clay
19 near Intake 3. The groundwater recharge in these soil conditions would occur above the
20 elevation of the top of tunnel either with or without the tunnel construction due to the
21 presence of stiff, moderate to high plasticity clays located in the tunnel zone.

22 A tunnel extends from Intake 3 to the Intermediate Forebay at depths of 80 to 120 feet
23 below the ground surface, as described in the *Delta Habitat Conservation &*
24 *Conveyance Program - Conceptual Engineering Report, Volume 2*. Exhibit SCWA 1
25 shows two community wells in Hood located to the west and to the east of the tunnel.
26 Soils near Intake 3 and Intake 4 to the north and south of Hood would consist of silty
27 sand and lean clay layers interspersed with clays and poorly graded sand to 100 to 120
28 feet below the ground surface, as described in the *2013 2009 Through 2012*

1 *Geotechnical Data Report, Pipeline/Tunnel Option.* The soil boring to the north of Hood
2 indicated silty sand between 100 to 120 feet below the ground surface underlain by
3 clay; and the soil boring to the south of Hood indicated lean clay and silty sand between
4 approximately 110 and 135 feet below the ground surface underlain by sand. The Well
5 "W-20" in Exhibit SCWA 1 is shown as having a screen between 122 and 132 feet
6 below the ground surface and a well depth to 340 feet below the ground surface. The
7 soils in this area appear to have interspersed silty sand, sand, lean clay, and fat clay. In
8 general, it appears that the upper soils above 100 feet below the ground surface are
9 more permeable and would generally allow groundwater to flow from the Sacramento
10 River to the east of the river above the tunnel structure or immediately below the tunnel
11 structure.

12 As described above, thorough site investigations and desk studies would be conducted
13 during design to identify the location of wells, depths of the wells and the depth to
14 groundwater in the vicinity of the construction activities. Based upon the results of these
15 studies, it is anticipated that monitoring wells would be installed prior to construction,
16 and mitigation measures would be implemented if groundwater elevations declined due
17 to the implementation of the proposed project.

18 **4. GROUNDWATER RECHARGE ALONG THE TUNNEL ALIGNMENT AND AT THE**
19 **INTERMEDIATE FOREBAY**

20 As presented in LAND 35 prepared by Mr. Tootle and oral testimony presented by Mr.
21 Tootle, it was discussed that installation of the CWF tunnels and the Intermediate
22 Forebay would reduce groundwater recharge in the vicinity of the tunnels and the
23 Intermediate Forebay. These assertions, however, are contradicted by the evidence that
24 the groundwater in the vicinity of the tunnels and the Intermediate Forebay would
25 continue to be recharged from adjacent water bodies.

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1 **5. TUNNEL ALIGNMENT BETWEEN INTAKE 5 AND THE INTERMEDIATE FOREBAY**
2 **AND THE INTERMEDIATE FOREBAY**

3 The tunnel alignment between Intake 5 and the Intermediate Forebay is located to the
4 east of Snodgrass Slough. Water appears to flow from Snodgrass Slough and North
5 Fork Mokelumne River into the groundwater adjacent to these water bodies, as
6 presented in the 2010 *Sacramento County General Plan Update, Final Environmental*
7 *Impact Report* (see Attachment 3).

8 Soils near Intake 5 to the first tunnel shaft location (south of Lambert Road) consist of
9 silty sands, poorly graded sands, and sandy silts within approximately 100 to 120 feet of
10 the ground surface based upon information from geotechnical borings in the vicinity of
11 the intakes completed by DWR, as reported in the 2013 *2009 Through 2012*
12 *Geotechnical Data Report, Pipeline/Tunnel Option*. These soils generally allow
13 groundwater to flow from the Sacramento River to the groundwater basin located to the
14 east of the river. Soils at elevations below 120 feet generally become clays or clays
15 interspersed with sandy silts which would have less permeability for groundwater
16 recharge. The tunnels would be located within the clay soils at depths below the more
17 permeable silty sands, poorly graded sands, and sandy silts; therefore, groundwater
18 would continue to flow from the Sacramento River in the upper soil layers above the
19 tunnel structures.

20 Soils between Lambert Road and the Intermediate Forebay appear to be primarily clay
21 loams and sandy clay loams with interspersed areas of silt loams and clay. The
22 proportion of clays increase along the alignment towards the Intermediate Forebay. This
23 information is based on soils information included in the Soil Conservation Service *Soil*
24 *Survey, Sacramento County, California* because there were no specific geotechnical
25 surveys conducted along this portion of the alignment. Due to the presence of clay
26 loams and clay, there is less groundwater recharge from Snodgrass Slough than in
27 other portions of the alignment with more permeable soils. However, the tunnels would
28 be located at depths below the clay loams that do allow the groundwater flow.

1 Therefore, groundwater recharge is anticipated to continue to flow in the clay loams
2 from Snodgrass Slough in the upper layers above the tunnel structure.

3 The Intermediate Forebay is located in an area with low groundwater recharge potential
4 (see Attachment 3). Currently, minimal groundwater recharge appears to occur to the
5 west of the Intermediate Forebay from Snodgrass Slough. In this area, it appears that
6 although groundwater recharge is minimal, the majority of the recharge is related to
7 flows from the Cosumnes River and North Fork Mokelumne River. Slurry walls around
8 the Intermediate Forebay (located north of Twin Cities Road) would extend into the less
9 permeable clay soils to reduce groundwater impacts during construction and operations
10 on adjacent groundwater. The slurry walls would reduce flow of groundwater from
11 Snodgrass Slough to areas located to the east of the Intermediate Forebay. However, it
12 appears that the groundwater recharge rate would be low and groundwater would
13 continue to flow into the area from the Cosumnes River and North Fork Mokelumne
14 River. Therefore, slurry walls would have minimal effect on groundwater recharge in the
15 vicinity of the Intermediate Forebay.

16 **6. TUNNEL ALIGNMENT BETWEEN THE INTERMEDIATE FOREBAY TO THE NORTH**
17 **FORK MOKELUMNE RIVER**

18 Soils along the tunnel alignment downstream of the Intermediate Forebay transition
19 from less permeable clay loams and sandy clay loams with interspersed areas of silt
20 loams and clay to soils characterized by clay loams and silty clay loams with sandy
21 loams and loams near the rivers based on soil information included in the Soil
22 Conservation Service *Soil Survey, Sacramento County, California*. Clay soils are
23 present at lower depths. Groundwater recharge appears to occur in this area from the
24 Cosumnes River and North Fork Mokelumne River (see Attachment 3). The tunnels
25 would be located in the clay soils below the loam soils. Groundwater recharge would
26 continue in the upper soil layers above the tunnel structures.

27 It is noted that Exhibit LAND 59 presents approximate locations of wells in Walnut
28 Grove along the Delta Cross Channel Slough, near Snodgrass Slough and the North

1 Mokelumne River, and along the Mokelumne River on New Hope Tract. All of these
2 wells are located along waterways that would not be occluded by the construction of the
3 tunnel structure approximately 110 feet below the ground surface in this part of the
4 alignment. Therefore, it is anticipated that groundwater recharge would continue from
5 the adjacent waterways into the groundwater used for water supplies.

6 **7. TUNNEL ALIGNMENT BETWEEN NORTH FORK MOKELUMNE RIVER AND**
7 **POTATO SLOUGH**

8 The tunnel alignment between the North Fork Mokelumne River and Potato Slough is
9 located along Staten and Bouldin islands. This area was identified in the 2009 *San*
10 *Joaquin County General Plan, Public Review Draft Background Report (Attachment 4)*
11 as an area of poorly drained soils with low recharge potential. The soils are
12 characterized as mucky clay loam, silty clay loam, and clay underlain by peat as
13 presented in Soil Conservation Service *Soil Survey, San Joaquin County, California*.
14 Soils near the waterways that surround these islands are characterized by silt loam and
15 silty clay loam underlain by peat. Staten Island is surrounded by the South Fork
16 Mokelumne River and North Fork Mokelumne River, and Bouldin Island is surrounded
17 by South Fork Mokelumne River, Mokelumne River, Potato Slough, and Little Potato
18 Slough. Although groundwater recharge rates are low, groundwater would continue to
19 flow from these water bodies to the groundwater on both sides of the tunnel alignment.

20 **8. TUNNEL ALIGNMENT BETWEEN POTATO SLOUGH AND CLIFTON COURT**
21 **FOREBAY**

22 Soils along the tunnel alignment between Potato Slough and Clifton Court Forebay are
23 primarily clay soils along Venice, Mandeville, Bacon, Woodward, and Victoria islands as
24 indicated by geotechnical borings in the vicinity of the intakes, that were completed by
25 DWR, as reported in the 2013 *2009 Through 2012 Geotechnical Data Report,*
26 *Pipeline/Tunnel Option*. This area was identified in the 2009 *San Joaquin County*
27 *General Plan, Public Review Draft Background Report (Attachment 4)* as an area of
28 poorly drained soils with low recharge potential. The islands are surrounded by Old

1 River, San Joaquin River, Middle River and connecting waterways between Old and
2 Middle rivers. Although groundwater recharge rates are low, groundwater would
3 continue to flow from these water bodies to the groundwater on both sides of the tunnel
4 alignment.

5 It is noted that Exhibit LAND 59 presents approximate locations of wells on the east
6 sides of Mandeville and Bacon islands between Middle River and the tunnel alignment,
7 on the west side of Bacon Island between Old River and the tunnel alignment, and on
8 Jones Tract which does not include the tunnel alignment. All of these wells are located
9 along waterways that would not be occluded by the construction of the tunnel structure
10 approximately 110 feet below the ground surface in this part of the alignment.

11 Therefore, it is anticipated that groundwater recharge would continue from the adjacent
12 waterways into the groundwater used for water supplies.

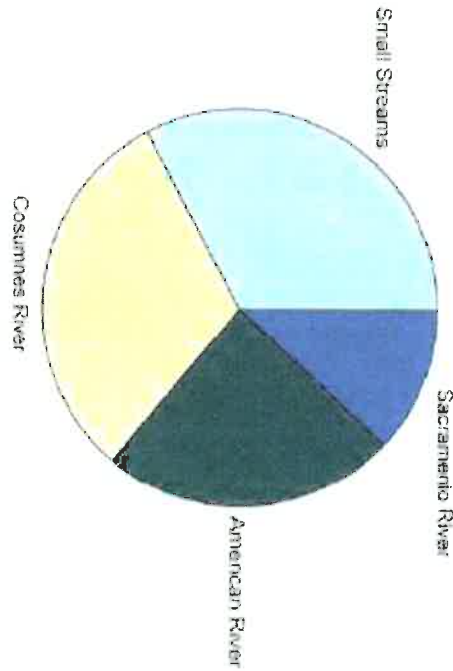
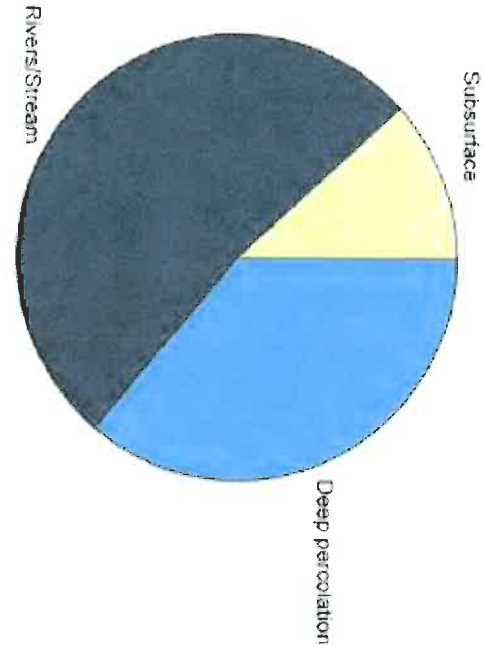
13 Clifton Court Forebay is located in an area with clay soils with low groundwater
14 recharge potential. The proposed forebay modifications would extend throughout the
15 entire Clifton Court Tract. Groundwater recharge would continue to occur on adjacent
16 tracts of land that are located across Old River, Italian Slough, and West Canal.

17 Therefore, slurry walls placed around Clifton Court Forebay would have minimal effect
18 on groundwater recharge in the vicinity of the forebay.

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1 ATTACHMENT 1 – FIGURE 2-16 IN THE 2006
2 CENTRAL SACRAMENTO COUNTY GROUNDWATER MANAGEMENT PLAN

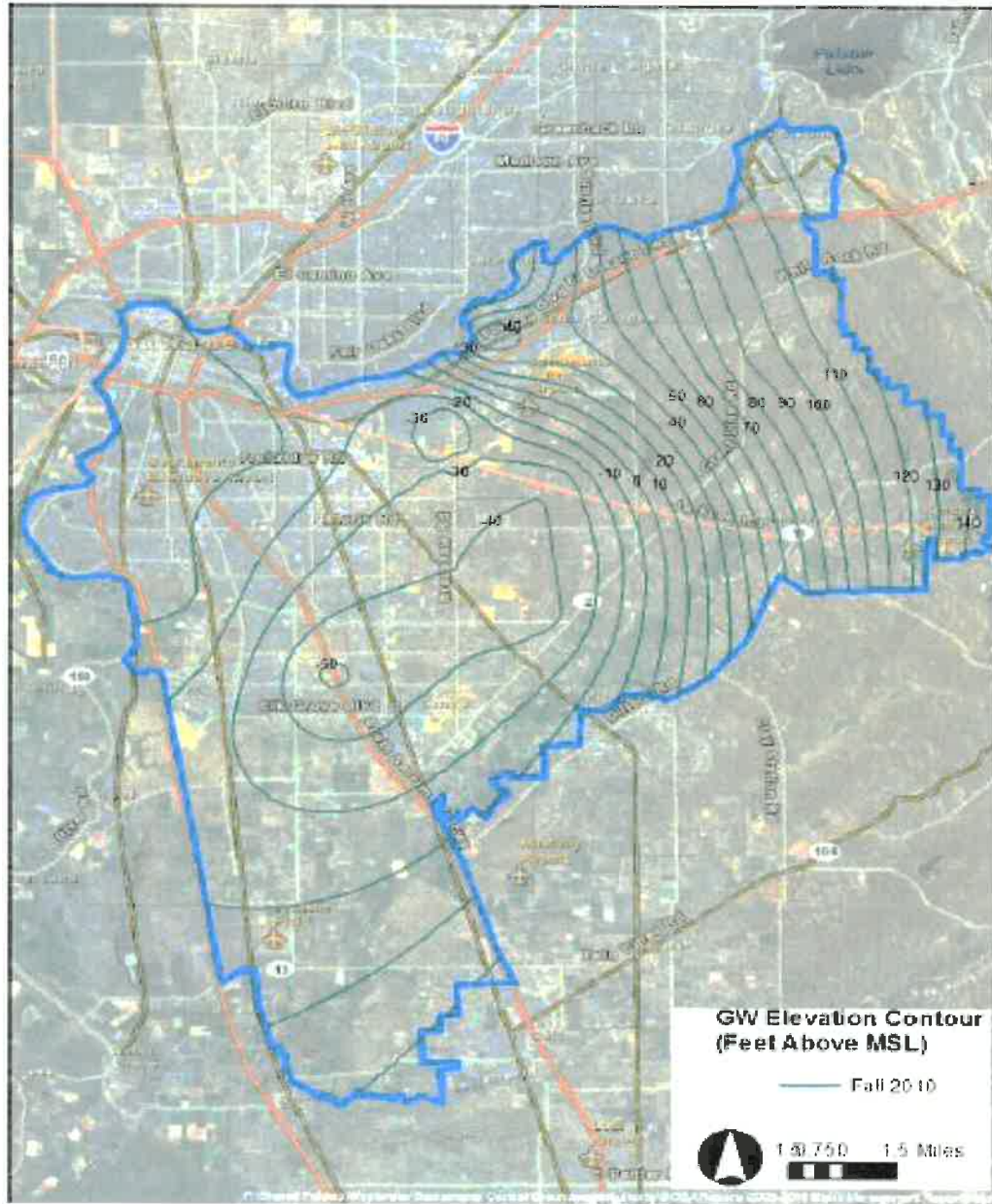
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Figure 2-16. Central Basin Recharge Sources



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1 ATTACHMENT 2 – FIGURE 7 IN THE SACRAMENTO CENTRAL GROUNDWATER
2 AUTHORITY BASIN MANAGEMENT REPORT 2009-2010

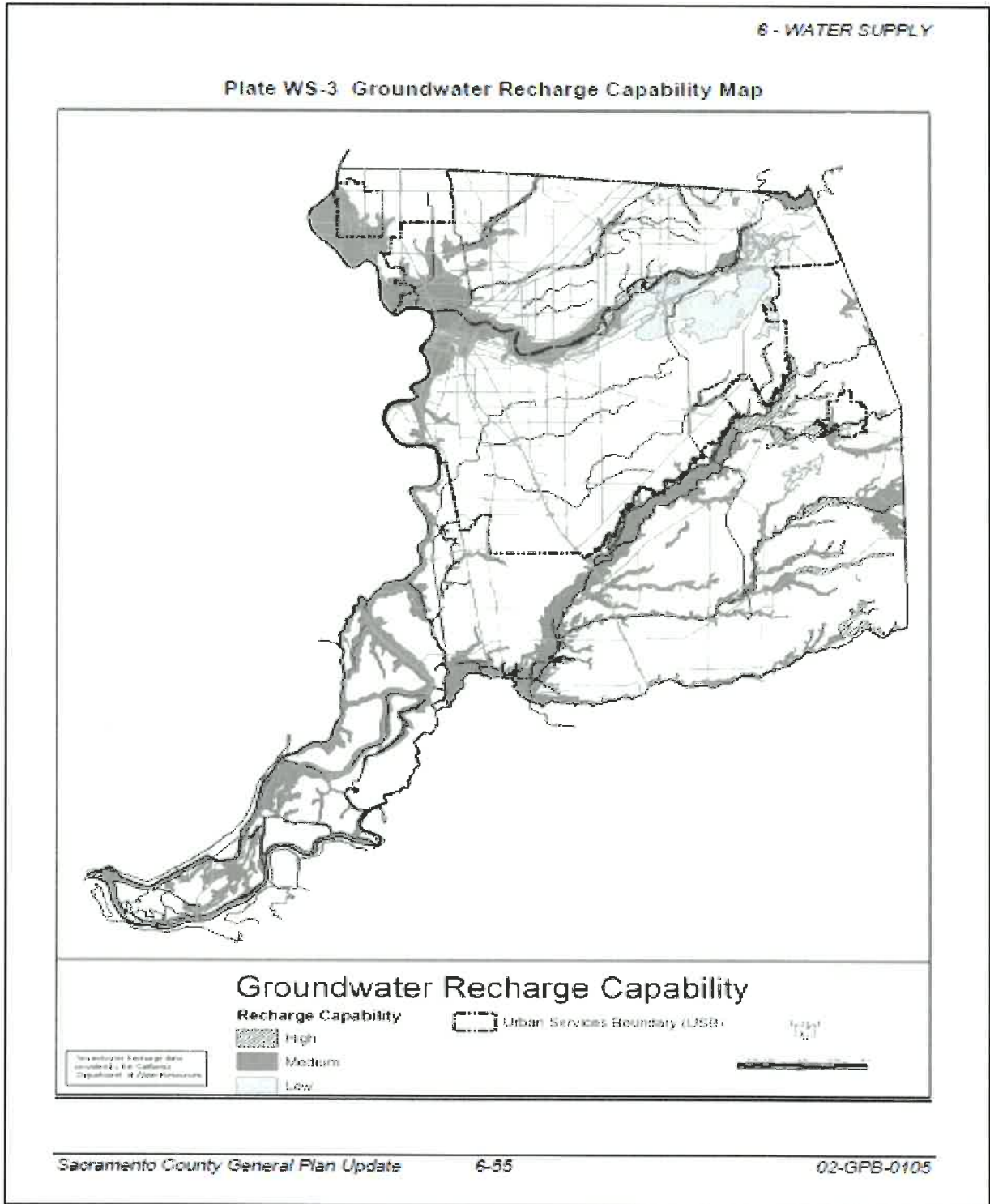
3 SCGA Biennial Basin Management Report
4 2009-2010



24 Figure 7 Fall 2010 Groundwater Elevation Contour Map

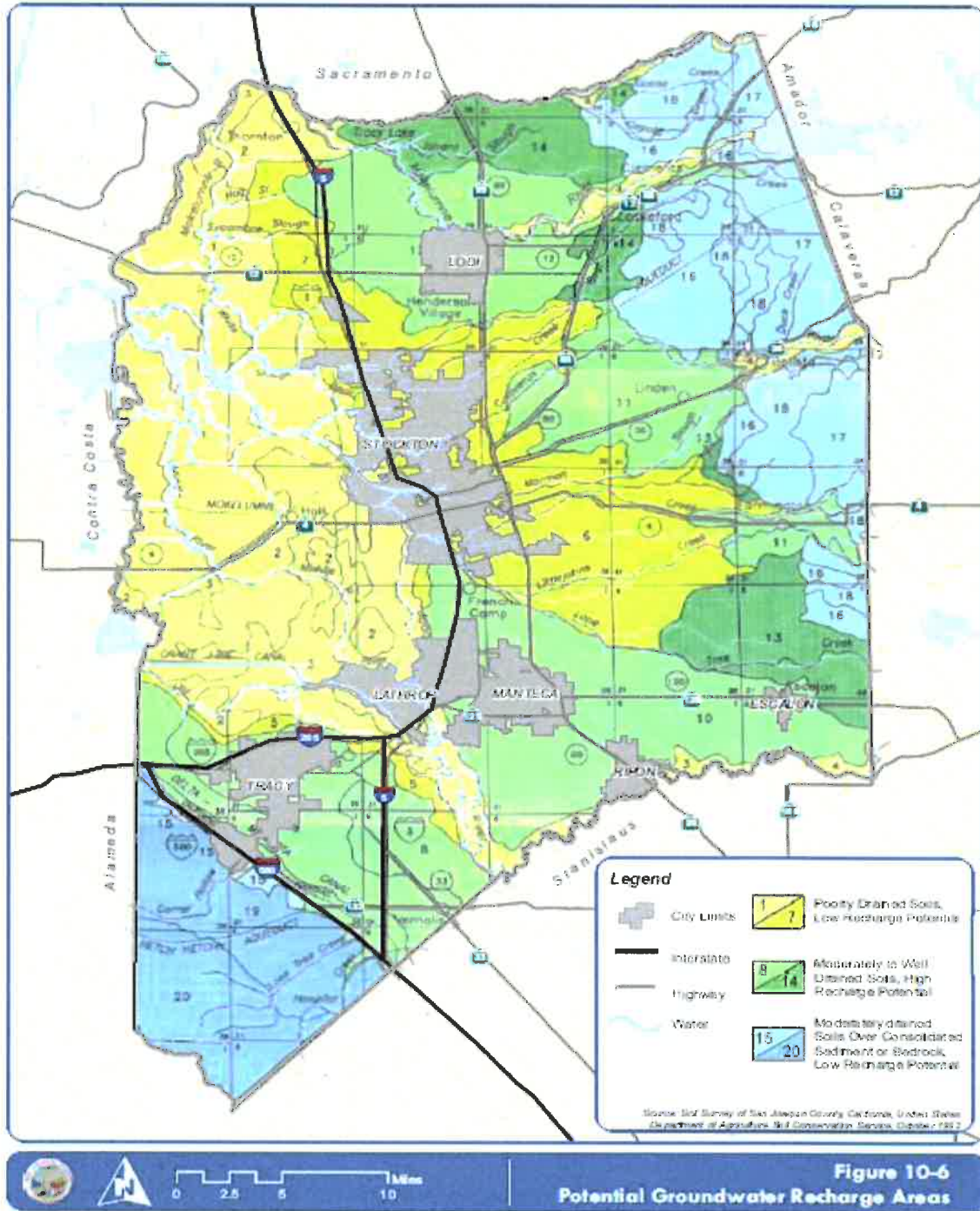
1 ATTACHMENT 3 – PLATE WS-3 IN THE 2010

2 *SACRAMENTO COUNTY GENERAL PLAN UPDATE, FINAL ENVIRONMENTAL IMPACT*
3 *REPORT*

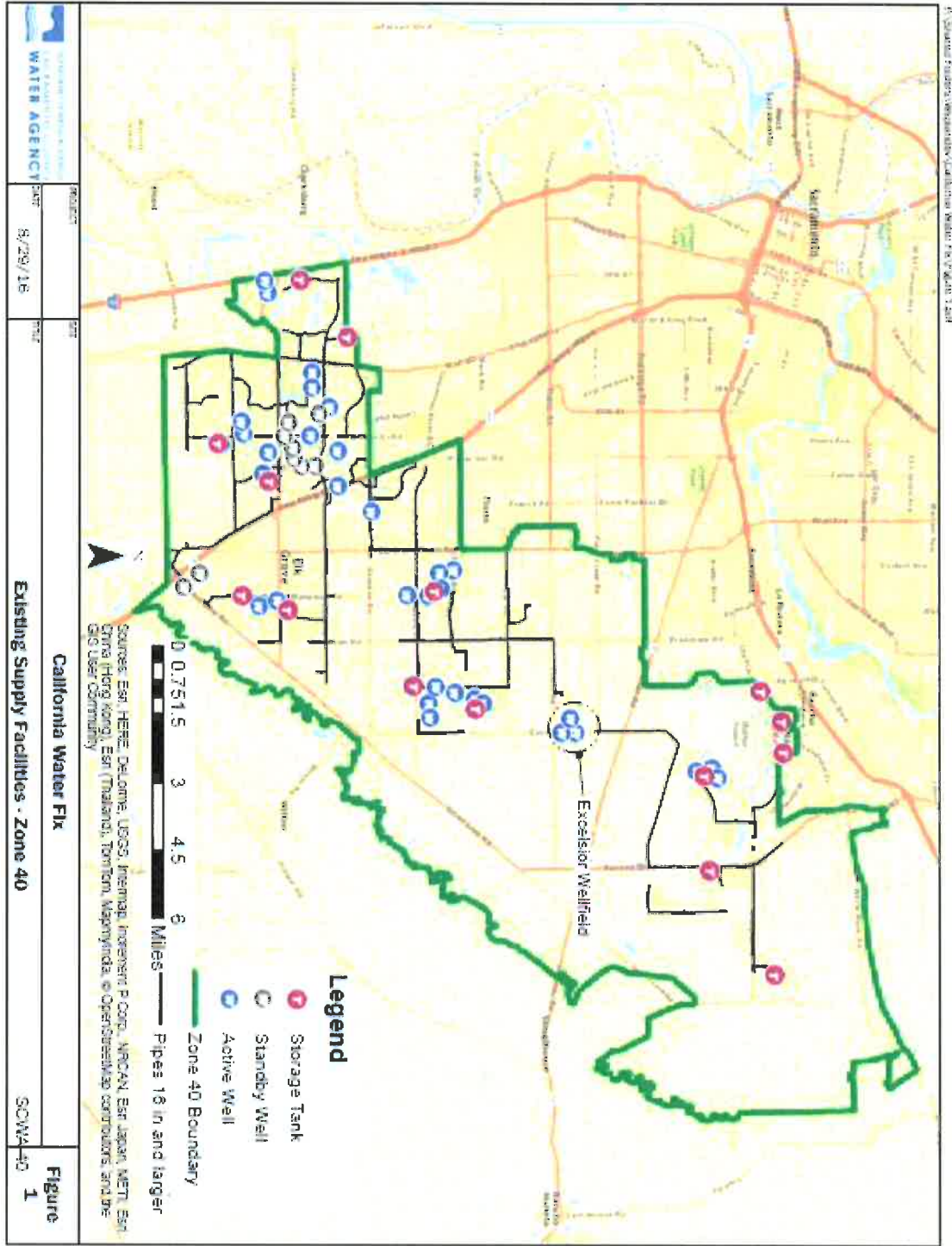


1 ATTACHMENT 4 – FIGURE 10-6 IN THE 2009

2 **SAN JOAQUIN COUNTY GENERAL PLAN, PUBLIC REVIEW DRAFT BACKGROUND**
3 **REPORT**



ATTACHMENT 5 – SWRCB EXHIBIT “SCWA 40”



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1 **II. EFFECTS OF PROPOSED INTAKE AND CONVEYANCE FACILITIES ON**
2 **GROUNDWATER IN SACRAMENTO COUNTY WATER AGENCY, ZONE 40**
3 **SERVICE AREA**

4 **POTENTIAL ISSUES:**

5 Operation of California WaterFix (CWF) Intakes would reduce instream freshwater flows
6 from the Sacramento River which would affect groundwater supplies used by
7 Sacramento County Water Agency (SCWA), Zone 40 Service Area (Zone 40). These
8 issues were introduced in Exhibit SCWA 4 and discussed by Dr. Steffen Mehl on behalf
9 of Zone 40 at the State Water Resources Control Board (SWRCB) hearing on October
10 26, 2016 [pages 126-135 and 230-232 of the transcript].

11 **RESPONSE SUMMARY:**

12 As described below, testimony presented to the SWRCB and reports prepared by
13 Sacramento County water agencies indicate that the Zone 40 wells are located to the
14 east of Interstate 5, and that the aquifer with the Zone 40 wells is primarily recharged
15 from water flowing from the Sierra Nevada foothills located to the east of Zone 40.
16 Model results presented in the Bay Delta Conservation Plan/California WaterFix
17 Environmental Impact Report/Environmental Impact Statement (BDCP/CWF EIR/EIS)
18 indicate that operations of the proposed CWF intakes under Alternative 1 would not
19 affect the groundwater aquifer located to the east of Interstate 5.

20 **1. GROUNDWATER RECHARGE OF ZONE 40 WELLS**

21 As presented in SCWA 4 and discussed in oral testimony, Dr. Steffen Mehl discussed
22 that the EIR/EIS did not address potential changes in groundwater due to the operations
23 of the CWF intakes; and that the operations of the CWF intakes would affect
24 groundwater in Zone 40. The assertions of Steffen Mehl are not supported by the
25 evidence. Groundwater model results in the BDCP/CWF EIR/EIS, Figure 7-14, show
26 that a maximum reduction of 5 feet in groundwater elevations along the Sacramento
27 River would occur due to operations of five intakes under Alternative 1B and that the
28 changes in groundwater elevations would not affect groundwater near Interstate 5 which

1 is the western boundary of Zone 40. The results would be similar under the proposed
2 Alternative 4A as can be determined by comparing the minimum Sacramento River
3 flows under Alternatives 1B and 4A.

4 Zone 40 serves a portion of Sacramento County located south of the American River
5 and north of the Cosumnes River with the most-western boundary that extends to
6 Interstate 5 and eastern boundary that extends to the edge of the foothills located to the
7 west of the Sacramento County line (see Exhibit SCWA 40 submitted to the SWRCB,
8 included as Attachment 5 to this paper).

9 Groundwater conditions within Zone 40 have been analyzed in several studies over the
10 past 15 years, including the 2004 *Sacramento County Water Agency Groundwater*
11 *Management Plan*, 2005 *Sacramento County Water Agency Zone 40 Water Supply*
12 *Master Plan*, 2006 *Central Sacramento County Groundwater Management Plan*, and
13 *Sacramento Central Groundwater Authority Basin Management Report 2009-2010*.

14 Information in these studies describe that groundwater in the groundwater basin that
15 includes Zone 40 is recharged from rivers (Cosumnes, American, and Sacramento
16 rivers), deep percolation of applied water, and subsurface flows along the Sierra
17 Nevada foothills. Figure 2-16 of the 2006 *Central Sacramento County Groundwater*
18 *Management Plan* indicate that Sacramento River provides the smallest amount of
19 groundwater recharge to the groundwater basin (see Attachment 1). The majority of the
20 recharge occurs along the Cosumnes River and small streams that flow from Sierra
21 Nevada foothills and from deep percolation of applied water.

22 Information presented in the *Sacramento Central Groundwater Authority Basin*
23 *Management Report 2009-2010* (Figures 4 through 7) show the groundwater elevation
24 contours with the most recent contours shown in Figure 7 (see Attachment 2).

25 Groundwater within an aquifer flows from higher elevations to lower elevations, and the
26 rate of flow will increase along steeper elevation changes (e.g., areas with contour
27 changes occurring with the least amount of horizontal space). Based upon the
28 groundwater contours shown in Figure 7 of the *Sacramento Central Groundwater*

1 Authority Basin Management Report 2009-2010, it appears that the lowest groundwater
2 elevation occurs near Elk Grove, located within Zone 40, and groundwater primarily
3 flows towards this portion of Zone 40 from the east. Groundwater elevations near the
4 Sacramento River appear to only be slightly higher than groundwater in Zone 40
5 (located to the east of Interstate 5). This report also describes that groundwater
6 elevations in the portions of the basin that includes Zone 40 have recently been stable
7 or have increased due to increased use of surface water in the area and fallowing of
8 lands previously irrigated with groundwater.

9 Therefore, based upon the information presented in these reports, recharge in the
10 groundwater basin that includes Zone 40 appears is not substantially affected by
11 recharge from the Sacramento River.

12 This conclusion is consistent with the modeling results presented in the BDCP/CWF
13 EIR/EIS, Figure 7-14. This figure presents the anticipated maximum reduction in
14 groundwater elevations along the Sacramento River due to operations of five intakes
15 under Alternative 1B. The results indicate that groundwater adjacent to the Sacramento
16 River between Intake 1 and Rio Vista would decline up to 5 feet during drier months
17 when the Sacramento River elevations would be at the lowest elevations. The changes
18 in groundwater elevations would not extend to Interstate 5, and would not affect wells in
19 Zone 40. It should be noted that Figure 7-14 provides results for operations of Intakes 1
20 through 5 under Alternative 1B. However, the results would be similar under the
21 proposed Alternative 4A as can be determined by comparing the minimum Sacramento
22 River flows under Alternatives 1 and 4A. As shown in Appendix 5A, Section C of the
23 BDCP/CWF EIR/EIS, changes in Sacramento River monthly flows downstream of the
24 North Delta Diversions as compared to the No Action Alternative are similar for the
25 evaluation of Alternative 1B and Alternative 4A (see Tables C-21-14 and C-60-6,
26 respectively).

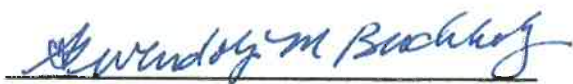
27 Overall, based upon information prepared for Zone 40 groundwater conditions and
28 results from groundwater monitoring presented in the BDCP/CWF EIR/EIS, it does not

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appear that operations of the North Delta Diversions would substantially affect groundwater recharge in Zone 40.

It also should be recognized that the BDCP/CWF EIR/EIS acknowledges that detailed hydrogeological analyses were not completed during the preparation of the EIR/EIS. As part of the environmental commitments of the project, thorough site investigations and desk studies would be conducted during design to identify the location of wells, depths of the wells and the depth to groundwater in the vicinity of the construction activities. Based upon the results of these studies, it is anticipated that monitoring wells would be installed prior to construction.

Executed on this 22 day of March, 2017 in Sacramento, California.



GWEN BUCHHOLZ